CLAIMS

1. A method for transpedicular vertebral attachment comprising the steps of

- drilling a pedicle with a drill as for example a twist drill in order to form a hole in the pedicle;
- removing the drill from the hole thus formed in the pedicle;
- screwing a plug into the hole in the pedicle thus formed by the twist drill; and
- thereby establishing an anchorage of the plug in the pedicle.

2. The method according to claim 1, wherein the plug has a first end and a second end and has an opening at the first end thereof which is not inserted into said hole formed in the pedicle, and said plug has a tubular stem being provided with equi-distantly spaced radial slits extending lengthwise along the stem at the second end; and a threaded portion of a screw is inserted into the opening of the plug provided at the first end thereof, whereby the plug is radially expanded at its second end, whereby an anchorage of the plug is established in the pedicle.

3. The method according to claim 1, further comprising the step of using a twist drill of 0.4 cm size.

4. The method according to claim 2, further comprising the step of using a screw which is made of steel, titanium or an alloy.

5. The method according to claim 2, further comprising the steps of

- providing a radially widened portion on the plug;
- providing a radial shoulder on the screw, the threaded portion of the screw extending from an end of the screw to the radial shoulder, the threaded portion of the screw being slightly longer than a length of the pedicle; and
- stopping inserting the screw into the hole in the plug by engagement of the radial shoulder with the radially widened portion of the plug.

6. The method according to claim 1, further comprising the steps of

- using a polymer or a metal or an alloy for the plug, the plug being biocompatible with the pedicle, the plug having a radially widened portion, said tubular stem of the plug extending from an end thereof to the radially widened portion, the tubular stem preferably having a length of 3.1 cm and a diameter of 0.5 cm, the radially widened portion forming a hexagonal head preferably having a diagonal measurement of 0.8 cm; and
- engaging the hexagonal head with a tool for manipulation thereof.

7. The method according to claim 2, further comprising the step of enlarging the radial slits to thereby widen the end of the plug which is screwed into the hole formed in the pedicle during the step of expanding the plug, the tubular stem having a first circumference adjacent the radially widened portion and having a second

circumference at the end which is screwed into the hole in the pedicle, the second circumference being larger than the first circumference after the step of enlarging.

8. The method according to claim 1, further comprising the steps of using silastic as the material of the plug, the plug being biocompatible with the pedicle, the plug having a radially widened portion and a tubular stem extending from an end thereof to the radially widened portion, the tubular stem preferably having a length of 3.1 cm and a diameter of 0.5 cm, and the radially widened portion forming a hexagonal head preferably having a diagonal measurement of 0.8 cm; and engaging the hexagonal head with a tool for manipulation thereof.

9. The method according to claim 8, further comprising the step of enlarging the radial slits to thereby widen the end of the plug which is screwed into the hole formed in the pedicle during the step of expanding the plug, the tubular stem having a first circumference adjacent the radially widened portion and having a second circumference at the end which is screwed into the hole in the pedicle, the second circumference being larger than the first circumference after the step of enlarging.

10. A system for transpedicular vertebral attachment comprising

- a drill, preferably a twist drill, for forming a hole in the pedicle;
- a plug being insertable, with one of its ends, into the hole in the pedicle formed by the drill, whereby an anchorage of the plug in the pedicle may be obtained.

11. The system for transpedicular vertebral attachment according to claim 10, wherein the plug comprises a first end and a second end and has, at its first end, an opening provided therein, the second end of the plug being insertable into the hole in the pedicle formed by the drill and having a tubular stem being provided with equidistantly spaced radial slits extending lengthwise along the stem; and the system comprises means for expanding the second end of the plug to thereby enlarge the second end to form an anchorage of the plug in the pedicle, the means for expanding comprising a screw which insertable, preferably may be screwed, into the opening in the first end of the plug.

12. The system for transpedicular vertebral attachment according to claim 10, wherein the drill has a size of 0.4 cm.

13. The system for transpedicular vertebral attachment according to claim 11, wherein the screw is made of steel, titanium or an alloy.

14. The system for transpedicular vertebral attachment according to claim 11, wherein the plug has a radially widened portion and the screw has a radial shoulder, the screw having a threaded portion which extends from an end of the screw to the radial shoulder, the threaded portion of the screw being slightly longer than a length of the pedicle, the radial shoulder of the screw being adapted to engage the radially widened portion of the plug to be able to stop an insertion of the screw into the opening of the plug.

15. The system for transpedicular vertebral attachment according to claim 10, wherein the plug is made of one material selected from a polymer, a metal or an alloy and is biocompatible with the pedicle the plug having a radially widened portion, the tubular stem extending from the second end thereof to the radially widened portion, the tubular stem preferably having a length of 3.1 cm and a diameter of 0.5 cm, and the radially widened portion forming a hexagonal head preferably having a diagonal measurement of 0.8 cm.

16. The system for transpedicular vertebral attachment according to claim 11, wherein the radial slits are enlarged by the means for expanding to thereby widen the second end of the plug, the tubular stem having a first circumference adjacent the radially widened portion and having a second circumference at the end which is screwed into the hole in the pedicle, the second circumference being larger than the first circumference after the means for expanding enlarges the second end of the plug to form an anchorage in the pedicle.

17. The system for transpedicular vertebral attachment according to claim 11, wherein the plug has a radially widened portion and the tubular stem extending from the second end thereof to the radially widened portion, the means for expanding enlarges the radial slits to thereby widen the second end of the plug, the tubular stem having a first circumference adjacent the radially widened portion and having a second circumference at the end which is screwed into the hole in the pedicle, the second circumference being larger than the first circumference after the means for expanding enlarges the second end of the plug to form an anchorage in the pedicle.

18. The system for transpedicular vertebral attachment according to claim 11, wherein the plug is made of silastic and is biocompatible with the pedicle, the plug having a radially widened portion, the tubular stem extending from the second end thereof to the radially widened portion, the tubular stem preferably having a length of 3.1 cm and a diameter of 0.5 cm, and the radially widened portion forming a hexagonal head preferably having a diagonal measurement of 0.8 cm.

19. The system for transpedicular vertebral attachment according to claim 18, wherein the radial slits are enlarged by the means for expanding to thereby widen the second end of the plug, the tubular stem having a first circumference adjacent the radially widened portion and a having second circumference at the end which is screwed into the hole in the pedicle, the second circumference being larger than the first circumference after the means for expanding enlarges the second end of the plug to form an anchorage in the pedicle.

20. A device for connecting an attachment rod and a pedicular plug in a transpedicular vertebral attachment system, said device comprising:

- a generally cylindrical, C-shaped member having two ends which form an opening therebetween, the C-shaped member further having a centrally disposed opening, a ball joint being housed in said centrally disposed opening of the C-shaped member, the attachment rod being housed in the ball joint, the ball joint being in direct engagement with the attachment rod;
- a pair of hollow cylinders, one of the cylinders being attached to each end of the C-shaped members, a screw being received in both of the hollow cylinders, the screw being received insertable in the pedicular plug; and

- a means, preferably a nut, for locking the screw in position in the pair of hollow cylinders.

21. The connecting device according to claim 18, wherein the ball joint has a diamond point finish in direct contact with the attachment rod.

22. A dorsolumbar and lumbosacral vertebral fixation system, wherein the system consists of one or various connectors or couplings (111), a rod (112), a transversal traction device and means of vertebral fixation, with assembly carried out by the attaching the tail (114) of the vertebral element - coupling (111) - rod (112), the first assembly stage of the system being the introduction of the fixation elements, either to the pedicle or the vertebral laminae, a second stage of the insertion of the rod (112) through the connectors (111), and a third stage in which the connectors are connected to the tails (114) of the fixation elements by means of locknuts (120).

23. The dorsolumbar and lumbosacral vertebral fixation system, as in claim 22, wherein the connectors (111) are made up of an annular body (121) and two clamp elements (122) with the insertion of an open swivel (113) inside the annular body (121).

24. The dorsolumbar and lumbosacral vertebral fixation system, as in claim 22, wherein, with the clamp (122) open in its natural position, the swivel (113) turns freely in its housing, preferably with three degrees of freedom, in a radius exterior to the swivel (113) slightly smaller than the inside of the ring (121) of the clamp, both being concentric radii.

25. The dorsolumbar and lumbosacral vertebral fixation system, as in claim 22, wherein the open clamp (122) has a transversal circular orifice into which the tail (114) of the fixation elements is inserted.

26. The dorsolumbar and lumbosacral vertebral fixation system, as in claim 22, wherein the open clamp (122) has an adjustable transversal orifice (123) that allows for different tail (114) positions of the vertebral fixation elements.

27. The dorsolumbar and lumbosacral vertebral fixation system, as in claim 22, wherein the open swivel (113) is hollow with a circular shape (125) through which the rod (112) passes.

28. The dorsolumbar and lumbosacral vertebral fixation system, as in claim 22, wherein the exterior surface of the swivel (113) has a rough finish, which allows for better contact between surfaces when tightened.

29. The dorsolumbar and lumbosacral vertebral fixation system, as in claim 22, wherein the screw tightness of the tail (114) of the vertebral fixation element on the clamp (122), closes the body of the clamp which, in turn, closes the swivel (113) opening-slot (124), thus tightening onto the previously oriented rod (112), fixing it in place.

30. The dorsolumbar and lumbosacral vertebral fixation system, as in claim 22, wherein, as a vertebral fixation element, an expansion screw (116) is used, this being a hollow pedicle screw, smooth on the inside, through which a pin (128) is passed.

31. The dorsolumbar and lumbosacral vertebral fixation system, as in claim 22, wherein the screw head has an interior thread in order to house, threaded in, the Allen-type screw of the screw head (130) of the pin (128).

32. The dorsolumbar and lumbosacral vertebral fixation system, as in claim 22, wherein the expansion screw consists of lengthways slots (127), which start towards the middle of its threaded length, and which are opened by fully inserting the pin (128).

33. The dorsolumbar and lumbosacral vertebral fixation system, as in claims 22, wherein the diameter of the lower third of the expansion screw (116), when the pin is fully inserted, progressively increases towards the end, until it reaches its maximum at the tip, between 20 and 30% when completely expanded.

34. The dorsolumbar and lumbosacral vertebral fixation system, as in claim 22, wherein the expansion screw (116) is used in cases of osteoporosis vertebrae, re-interventions and for the sacral vertebrae, in order not to penetrate the anterior cortical layer.

35. The dorsolumbar and lumbosacral vertebral fixation system, as in claim 22, wherein prior to the insertion of the expansion screw (116) the bone is tapered to the same thread as the external thread of the expansion screw.

36. The dorsolumbar and lumbosacral vertebral fixation system, as in claim 22, wherein the expansion screw (116) consists of a lengthways interior hollow conduit, with an internal taper (129) towards the end, in such a way that when the pin is inserted (128), without making up the head (130) the tip of this pin reaches the said inclined plane (129).

37. The dorsolumbar and lumbosacral vertebral fixation system, as in claim 22, wherein, when the head (130) of the pin (128) is made up on the tail (114) of the expansion screw (116) the tip of the pin (128) opens the internal taper (129) forcing the slots (127) of the screw (126) to open out, expanding the screw against the sponginess of the vertebral body.

38. The dorsolumbar and lumbosacral vertebral fixation system, as in claim 22, wherein, as a fixation element a laminar (131) hook (115) is used, which couples onto the vertebral lamina by means of a hook finger and is screwed to the coupling (111) at the top.

39. The dorsolumbar and lumbosacral vertebral fixation system, as in claim 22, wherein, as a vertebral fixation element a pedicle (132) hook (115) is used, which couples onto the pedicle of the vertebra by means of a concave shape on the finger of the hook, and is screwed to the coupling (111) at the top.

40. The dorsolumbar and lumbosacral vertebral fixation system, as in claim 22, wherein, as a fixation element an open tail (118) hook (115) is used, as a top connection directly to the rod (112), being closed and attached by means of a locknut (120) and a locking setscrew (119).